STARLOG

Field Test Unit
Software

Model 6401 B
(Canon X-07)

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1. INTRODUCTION

The purpose of this documentation is to describe the function and operation of the Model 6401B Field Test Unit in conjunction with UNIDATA's Portable Data Logger. This document is aimed at the inexperienced user who is unfamiliar with the Field Test Unit (FTU).

The Portable Data Logger and Field Test Unit act as a team for the collection and transfer of data from remote, unmanned locations. The data logger is a battery operated data gathering unit, and the Field Test Unit is a portable dedicated computer with specialized software for communication with the data logger.

1.1 PORTABLE DATA LOGGER

The Portable Data Logger (PDL) is a microprocessor based device designed to have a battery lifetime of over 2 years. This allows the logger to remain in the fields for long periods of time for the recording of data. The data is recorded in CMOS RAM memory which is available in 8K to 64K capacities. The logger provides analogue and digital inputs for data sampling, and internal logger programs and crystal clock for the recording of data in the logger's memory.

1.1.1 Memory structure

The memory of the logger is divided into 256 byte Blocks (e.g. a 24K logger will have 96 blocks, and a 64k logger has 256 blocks). Hence, any particular location in the logger's memory can be referred to in two ways: either by its absolute location in memory, or by its block and location within that block (e.g. absolute location 0 is also block 0 location 0; absolute location 1023 is block 3 location 255).

Block 0 is used to store the clock, pointers, counters, accumulators, channels and other information necessary to the running of the logger.

Block 1 is used to store Buffer Pointer information (BLK 1, LOC 0) and the Data Logger program (BLK 1, LOC 128)

Blocks 2 & 3 are reserved for the Data Logger Program.

Blocks 4 onwards (location 1024 to the end of memory) are reserved for logger data storage. Bytes are logged sequentially, without gaps, and the number of bytes logged per log interval will depend on the PDL program.

1.2 FIELD TEST UNIT

The Field Test Unit (FTU) is a battery powered, Intel 8085 based microcomputer with resident Microsoft BASIC (20K ROM). Memory capacities of 8K or 16K RAM are available for program and data storage. RAM memory is divided between a text area and a file area. The text area is used for loading and executing BASIC programs. The file area is used to store Program and Data files. Files in the file area are called RAM files. Both the text area and the file area are retained when the FTU is switched off, but these areas will be cleared if the batteries are removed.

1.2.1 Why use a FTU?

The Field Test Unit allows the programming and interrogation of the data loggers in the field. The FTU can be used to :

- Display and alter channels, accumulators, and memory locations in the data logger.
- Unload the logger into a RAM file or onto cassette.
- Load the logger with new programs from a RAM file or from cassette.
- Transfer logger data and programs between the FTU, cassette, and a host computer.

1.2.2   Installation

The FTU should come with the following:

- X-07 (the FTU)
- CANNON X-07 User's Guide
- BASIC Reference Manual
- Programming Guide for Beginners
- Reference Card (for X-07)

- Batteries (AA x 4)
- Model 6602E cable to connect FTU to Data Logger
- Model 6401D Mains Power Pack
- Prom with STARLOG Software (already installed)
- Reference Card for (FTU)

1.2.3 Switching on the FTU

Ensure that the batteries have been inserted and that the Lock Switch (slide switch, underneath) is in the ON position, then press the ON/BREAK key. The FTU should power on and the following appear on the screen :

> Copyright(c) 1983 by
> Microsoft & Canon
> 14940 Bytes free

Note, however, that the number of Bytes free may differ from the above as it depends on the size of the file area that has been set (the size of the file area can be changed)

1.2.4 Running a Program

To run a program, use the BASIC command :

RUN"filnam"

where filnam is the name of the file you wish to run.

1.3 CASSETTE STORAGE

Cassettes may be used for long term storage of Programs and data. It is advisable to keep a copy of programs on cassette, as the contents of the file area may sometimes be destroyed.

1.3.1 Attaching the cassette

The cassette cable plugs into the small round DIN-type socket on the right hand side of the FTU. The other end of the cable has three plugs. These should be plugged into the cassette recorder as follows:

RED   MIC (Input)

GREY   EAR (Output)

BLACK   REM (remote control)

1.3.2 Saving a Program

To save a program on cassette, rewind the cassette to a blank section, then put the cassette recorder into RECORD.

To save a program that is in the file area type :

CSAVE"filnam"

Where filnam is the file name you wish the program to be saved under. It is usually good practice to save the program twice (on the same cassette), as a protection against corruption on the tape.

To save a program that is in the file area, first load it into the text area by using the LOAD command :

LOAD"filnam"

then save it on cassette as above.

1.3.3 Loading a Program

To load a program from cassette, rewind the cassette to the start of the file, then put the cassette recorder into PLAY, then type:

CLOAD"filnam"

Where filnam is the file name of the program you wish to load. If the file name is left out, then the next program on the tape will be loaded.

To save the program in the file area use the command :

SAVE"filnam"

2. GETTING STARTED

The STARLOG FTU Software Package Model 6302A consists of a cassette tape, a memory chip (6264LP) and this manual.

2.1 PROGRAMS

The Field Test Unit (FTU) (Canon X-07) is usually delivered complete with the "FTU" prom loaded and ready to use.

The following programs are not loaded into the RAM file but are stored on the cassette tape which is included as part of the STARLOG FTU Software Package:-

FTUC   Provides interrogation and testing of the Data Logger in the field.

LOAD   Lead programs into the Data Logger, Unload recorded information from the Data Logger.

COPY   Transfer Data Logger information between FI'U RAM, cassette tape or RS-232 host computer.

PLOT   Print or Plot Data Logger recorded information.

PLOTX   As above plus extended features such as plot averaging, maxima, minima and total calculations.

2.1.1 Filename Extensions

Files saved in the FTU RAM directory will have the following file extensions:-

"D"   means a Data File or Logger Program
"P"   means a Program FiIe written in BASIC
"F"   means a Command File

2.2 FTU MEMORY GUIDE

The Field Test Unit comes complete with a 16k RAM which is sufficient to operate all UNIDATA supplied software. The FTU RAM may be expanded to 24k with an 8k memory card.

To use the 8k 6264LP RAM supplied to increase the FTU memory to 16k switch the FTU off and remove the cover of the chip socket on the back of the FTU.

Replace the FTU ROM with the RAM chip and change the memory select switch from ROM to RAM. Replace the cover press the reset button on the back of the FTU and switch on.

R A M	Programs in RAM	Command Files	Log Programs	Data
16K	PLOT (in text area)	RAM/Cassette	RAM/Cassette	Cassette
16K	LOAD/COPY/FTUC (in RAM file)	RAM/Cassette	RAM/Cassette	Cassette
24K	PLOT/COPY/FTUC	RAM/Cassette	RAM/Cassette	Cassette

2.3 FTU INITIALIZATION

If for any reason the FTU programs need to be loaded, the following procedure should be used:-

1. Using a pencil, press the RESET button at the rear of the FTU. (This is a Master Reset, so ALL PROGRAMS WILL BE LOST).

2. Connect FTU to Cassette Recorder with Model 6302A software cassette tape inserted/rewound and ready to use.

3. Press ON/BREAK key on the FTU. The message "14940 Bytes free" will appear. (Note: at least 14940 Bytes are required to operate this software, more 'free' bytes are fme).

4. Type:- FSET 10000 Return (2300 if using PLOT/PLOTX)

5. Type:- CLOAD "FTUC" Return (system should respond with 'Found FTUC' and then continue to read the program FTUC from the cassette tape and store it in the FTU)

6. Type:- SAVE "FTUC" Return (to save the program FTUC permanently in the FTU's RAM file area.) SAVE "LOAD/UNLOAD"

7. Repeat Steps 5 & 6 above to Load & Save programs "LOAD" and "COPY". Program "PLOT" may also be loaded if there is sufficient RAM in the FTU [in this case, "PLOT" should be LOAD(ed) and SAVE(ed) first, then "FTUC", "LOAD" and "COPY").

Note:- all programs on the cassette are stored twice. This means the message "SKIP : FTUC" might appear on the screen first before the next file is loaded

8. Type:- NEW then press Return

All FTU programs are now loaded and ready to use.

9. Type:- RUN "FTUC" then press Return

(To begin FTUC operating. Press BREAK key then RUN "LOAD" or RUN "COPY" to begin those programs)

2.4 LOADING "PLOT" IN 16K RAM FTU

The Model 6302A Software Support (Version V#5.0 or later) requires a 16k memory FTU (Canon X-07), therefore only the Print/Plot Package can be loaded into the FTU If the FTU has been expanded to 24k, then other FTU utilities may also be loaded and the Print/Plot Package may be saved as a RAM file in the FTU.

To load program "PLOT" (the Print/Plot Package):-

1. DELETE all RAM files in the FTU (or perform Step 1. above).

2. Connect cassette player (Step 2. above) and insert tape, side B.

3. Type:- FSET 2300 then press Return

4. Type:- CLOAD "PLOT" then press Return

(The system should respond with 'Found:PLOT' and con- tinue to load the program into the FTU)

Note:- don't save "PLOT" in the RAM file area (in a 16k FTU).

5. Type:- RUN then press Return

(To begin execution of the Print/Plot package).

3. (UN)LOAD, PLOT & COPY

The Model 6302A Software Support Package (Version V#5.0 or later) (Un)load/Plot/Copy allows information to be unloaded from a Data Logger and printed or plotted on a printer/plotter (Canon X-710) attached to the Field Test Unit (Canon X-07). In print mode, any standard 80 column printer may be used when interfaced to the FTU via the 'Centronics' printer interface or RS-232 communications interface.

In addition, program and data files may be transferred between cassette, RAM, Data Logger and a host computer in various formats.

3.1 STANDARD FEATURES

The (Un)load/Plot/Copy package will:-

a) unload a Data Logger and store the resulting data in a RAM file (requires 24k) or a cassette file on a datacassette tape.

b) load a logger program from a RAM file or a cassette file into a Data Logger.

c) print the contents of an unloaded Data Logger direct or from a RAM file or a cassette file in a tabular (column) format (up to 8 channels/fields per print) onto a Canon X-710 printer/plotter, a Centronics interfaced 80 column printer or a RS-232 interfaced 80 column printer.

d) plot the contents of a Data Logger direct or from a RAM file or a cassette file in a four color multi-plot format (up to 8 channels/fields per plot) onto a Canon X-710 printer/plotter.

e) transfer unloaded information or logger programs between a host computer and the FTU in ASCII format via an RS-232 communication channel.(see Appendix A for message format).

f) transfer unloaded information or logger programs between an IBM-PC type system and the FTU in LOGGER message format. (using the IBM-PC utility program "PDLIO"). Print or plot logger files direct from an IBM-PC type system (using the PDLIO utility program).

NOTE: The IBM-PC utility program PDLIO is not part of the (Un)load/Plot/Copy Software Package. Program PDLIO is included within the STARLOG Software Support Package for the IBM-PC (and

compatibles). If you require to use PDLIO you must purchase that package separately.

g) copy data files and command files between cassette, RAM and the RS-232 communication channel (host computer).

h) save frequently used (Un)load/Plot operator responses into command files in RAM or on cassette.

3.2 COMMAND FILES

Once the format of the (un)load or print/plot output has been decided, the operator commands (entered into the keyboard in response to the questions listed below) may be saved in a RAM file or on cassette.

This feature saves the operator entering all the responses every time a plot or unload is performed. Instead, the operator simply enters in the command file name and the (un)load or print/plot proceeds automatically using the pre-saved operator commands from that command file.

Many command files may be created and saved, allowing command files for a variety of loading, unloading, printing or plotting operations.

3.3 COPY(ING)   FILES

The "COPY" program allows data files or command files to be transferred to/from RAM/cassette or to/from FTU and a host computer. These files must be standard BASIC files in ASCII format (lines terminated with a carriage return and less than 255 characters in length).

3.3.1 Running COPY

1. Connect datacassette and/or RS-232 link to FTU

2. Type:- RUN "COPY" then press Return

3. Answer the following questions:

3.3.2 COPY - Operator Responses

Question	Answer
Cassette or Ram file INPUT file or Xfr (RS-232)?	C = Cassette file R = RAM file X = RS-232 communication channel to a host computer.
Enter Input file name, type	Name of Input file,extension (default ,D)

The above two questions are repeated for the OUTPUT file.

Baud Rate?	You have selected Xfr mode. Maximum Baud rate is 8000. (use 8000/4800/2400/ 1200/300) Note: if cassette selected Baud Rate is not asked for.

3.3.3 Timing considerations

When copying a file from a host computer (via the RS-232 communications channel) to a RAM file in the FTU, a delay of two (2) seconds must be provided by the host computer after sending each line before the next line of the fiIe is sent to the FTU. This delay must be increased to thirty (30) seconds per line when the FTU is storing the file on a data cassette.

NOTE: The transfer to/from a host computer is terminated by the last line containing the termination word END followed by a carriage return. (i.e."END" then press Return)

3.4 (UN)LOADING TO CASSETTE/RAM

Either program "PLOT" or program "LOAD" may be used to unload data from a Data Logger.

"PLOT" contains all the features of "LOAD" but "PLOT" (un)loading is slower and requires a larger amount of RAM (memory).

3.4.1 Running LOAD

1. Connect Data Logger to FTU. (connect datacassette)

2. Type:- RUN "LOAD" then press Return (or RUN "PLOT")

3. Answer the relevant questions described below

3.5 PRINTING & PLOTTING RECORDINGS

The program "PLOT" is used to print or plot the recorded information from the Data Logger. This information may be from stored files in RAM or on cassette or alternatively, "PLOT" will print/plot directly from a Data Logger connected to the FTU.

3.5.1 Running PLOT

1. Connect datacassette or Data Logger to FTU

2. Connect & RESET printer Or plotter to FTU

3. Type:- RUN then press Return (or RUN "PLOT")

4. Answer the relevant questions described below

3.6 LOAD/PLOT - OPERATOR RESPONSES

Question	Answers
input from Keyboard **input from File; or** **Create Command file?**	K = Keyboard entry of commands F = Commands are to be read from a previously created command file C = Store entered commands in a command file for future use

Enter the way you wish commands to be entered to the program
Note:- if "C" is selected, the program creates a command fife only. It does not perform any LOAD/COPY/PLOT function.

Cassette or Ram file **COMMAND file?**	C = Cassette storage R = Ram storage

Enter the storage device of the command file

Enter COMMAND file name,type	Name of command file,extension (,F is default extension)

Enter the name you of the command file you wish to create or use

PLot, PRint, Load or Unload	PL = Plot data logger information PR = Print data logger information L = Load file into the logger U = Unload data logger into file

Enter the function you wish PLOT to perform. Either PL to PLOT data, PR to PRINT data, L to LOAD data from storage device to a logger or U to UNLOAD data from a logger to storage device

Cassette or Ram file INPUT file, or input from Logger?	C = Cassette storage R = Ram storage L = Direct from logger

Enter the storage device that data is to be printed/plotted from

Cassette or Ram file INPUT file	C = Cassette storage R = RAM storage

Enter the storage device data is to be loaded from

Cassette or Ram file OUTPUT file?	C = Cassette storage R = RAM storage (24K F.T.U. only)

Enter the storage device data is to be unloaded to

Enter Output file name,type	Name of data file,extension (,D is default extension)

Enter the name you wish give your stored data. This name will be used for subsequent reference to that data

use buffer 7 time?	if your logger uses buffer 7 to store the start time, then stored times are used. Y = YES (use stored times) N = NO (enter start time on keyboard)

If the program in the logger has been created by the STARLOG IBM software package buffer 7 will contain the time of the first data log. This time can be used instead of having to enter a start time manually

Unload Format, **Pointers & buffer,** **Buffer or Done ?**	F = FORMAT (set of Block,Location,Count) P = Unload a buffer & all buffer pointers (B1,L0,C128) B = Unload a buffer (no pointers) (you enter the B,L,C yourself) D = DONE (proceed to (un)load)

Enter the format of the data you wish to operate on
F means that the data you wish to use is to be a contiguous block of logger memory.
B means the data is contained in one of the loggers 7 buffers.
P is the same as B except the data is to be used for future use and the buffer pointers are also to be saved.

Buffer number (0-7)	number of buffer to unload

Enter the buffer number (0 to 7) of the data you wish to operate on. Buffer 0 is normally used

B,L,C?	Block,Location,Count of the data to unload from the data logger

Enter the block and location (start) of the data and the number of bytes (count) of data you wish to operate on

Unload Time **Enter Date & Time** **HHMM DDMMYY** **?**	Time that logger stored first log HHMM DDMMYY entry (HHMMSS DDMMYY) SS - optional 1300 121086 HH = hours MM = minutes (SS = seconds optional) DD = day MM = month YY=year

An initial time is required in order to time reference all logged data. The time entered is used along with the log interval to be calculated when each log was made

Enter Input file **name, type**	Filename,extension (,D is default extension)

Enter the name of the stored data you wish to use. This name must be the same as the one used when the data was first stored

plot Format, Pointers **& buffer or Done?**	F = Formatted input. (set of B,L,C) P = Buffer & Pointer format D = Done (ready to Plot)

print Format,   F = Formatted input. (set of B,L,C)
Pointers & buffer   P = Buffer & Pointer format
Bypass, Skip buffer   B = Bypass data unloaded using "F" or "B"
or Done?   S =   "   "   "   " "P"
     D = Done (ready to Print)

Log interval (min)?   log interval of logger program in minutes

Enter the log period (the time between data recordings) of the logger program

Bytes per log?   number of bytes logged at each log interval
(max)

Enter the number of bytes recorded each log by the logger

Fields per log?   number of fields from each log that are to be Plot/Printed. (Separate channels)

Enter the number of fields of the log you wish to print/plot

Enter Scale Size (cm   Horizontal (X axis or time) scale (the
per hour)?   graph is plotted on its side)

Enter the scale of the time axis. This will determine how much paper the graph will use

Field []   Description of each field to be
bytes,from,to,units,   Print/Plotted.
(location,start,end)

bytes = size of field in bytes and optional conversion formula specifications (or any combination of size plus for-mula).
     RED = Red thermistor correction

from,to = are the scales to be used for the range (Y axis up the graph)   or the scale printed.

units = (optional) part of the title for the column/field.

location = (optional) byte position in the log entry where the field begins. If not specified then the next byte in the log entry is assumed to be the start of this field. (location is counted from 0, byte 0 being the 1st byte location in the log entry).

start,end = (optional) prescale values which set the limits of valid data for the log entry. If not specified, the data is assumed to range from 0 to 255 (or 0 to

256^bytes-1 for fields with a size greater than 1 byte)

example - the wind direction may be logged as a value 0 to 7 (8 compass directions in 45 deg steps)

FIELD 3: l,0,315,Wind   Dir„0,7

SAMPLE FIELD DESCRIPTIONS

FIELD 1:   1,0,255,1   BYTE (one byte with its actual value)

FIELD 2:   RED,0,80,TEMP   (Red thermistor probe)

FIELD 3:   RED MAX(2),0,80,Max   Temp,1 (maximum temperature every 2 hours, using field 2 values [PLOTX only])

Check Data Start Date & Time 15:54:40 21AUG'86 (Y/N)?	Time check for start of data

If this is the correct time for the start of logging enter Y

Check START Date & Time 15:54:40 21AUG'86 (Y/N)?	Time check for start of print/plot

If you wish to print/plot data starting at a time later than the log start time enter N

Check END Date & Time 15:54:40 22AUG'86 (Y/N)?	Time check for end of print/plot

If you wish to end print/plotting data at any time earlier than the log end time enter N

3.7   PRINT/PLOT/LOAD/COPY -   Examples

3.7.1 PRINT - Example

To print data logged in buffer 0 by a program that records four (4) temperatures. (2 using RED thermistor probes and 2 using AD590 probes).

Question	Operator Response
input from Keyboard input from File; or Create a command file?	K Input from keyboard
PLot, PRint, Load or Unload	PR Print a report
Cassette or Ram file INPUT file, or input from Logger?	L Read &ta from logger
use buffer 7 time?	Y The logger program recorded the time of the first log in buffer 7
print Format, Pointers & buffer or Done?	P Data is to come from a buffer
Buffer number (0-7)	0 The data is stored in buffer 0
print Format, Pointers & buffer or Done?	D No more data to print
Log interval (mill)?	60 The log program recorded every hour
Bytes per log?	4 The log program stored 4 bytes per log
Fields per log?	4 Print four fields from each log
Field 1 RED,0,60,Deg C bytes,from,to,units, (location,start,end)	Use red thermistor correction, range temp from 0 to 60, label Deg C
Field 2 RED,0,60,Deg C bytes,from,to,units, (location,start,end)	Use red thermistor correction, range temp from 0 to 60, label Deg C
Field 3 1,-10,60,Deg C, bytes,from,to,units, (location,start,end)	Use red thermistor correction, range temp from 0 to 60, label Deg C
Field 4 1,-10,60,Deg C bytes,from,to,units, (location,start,end)	Use red thermistor correction, range temp from 0 to 60, label Deg C

Check Data Start Date & Time 15:54:40 21AUG'86 (Y/N)?	Y Yes this is when the first log occurred
Check START Date & Time 15:54:40 21AUG'86 (Y/N)?	Y Yes, start printing data from this point on
Check END Date & Time 15:54:40 22AUG'86 (Y/N)?	Y Yes, finish printing data at this point

3.7.2 PLOT - Example

The following example is the same as the last but that the data is plotted instead of printed.

input from Keyboard input from File; or Create a command fife?	K Input from keyboard
PLot, PRint, Load or Unload	PL Plot a report
Cassette or Ram file INPUT file, or input from Logger?	L Read data from logger
use buffer 7 time?	Y The logger program recorded the time of the first log in buffer 7
plot Format, Pointers & buffer or Done?	P Data is to come from a buffer
Buffer number (0-7)	0 The data is stored in buffer 0
plot Format, Pointers & buffer or Done?	D No more data to print
Log interval (mill)?	60 The log program recorded every hour
Bytes per log?	4 The log program stored 4 bytes per log
Fields per log?	4 Print four fields from each log

Enter scale size (cm per hour)?	1 1cm of graph = lhour
Field 2 bytes,from,to,units, (location,start,end)	RED,0,60,Deg C Use red thermistor correction., range temp from 0 to 60, label Deg C
Field 2 bytes,from,to,units, (location,start,end)	RED,0,60,Deg C Use red thermistor correction, range temp from 0 to 60, label Deg C
Field 3 bytes,from,to,units, (location,start,end)	1,-10,60,Deg C, Use red thermistor correction, range temp from 0 to 60, label Deg C
Field 4 bytes,from,to,units, (location,start,end)	1,-10,60,Deg C Use red thermistor correction, range temp from 0 to 60, label Deg C
Check Data Start Date & Time 15:54:40 21AUG'86 (Y/N)?	Y Yes this is when the first log occurred
Check START Date & Time 15:54:40 21AUG'86 (Y/N)?	Y Yes, start printing data from this point on
Check END Date & Time 15:54:40 22AUG'86 (Y/N)?	Y Yes, finish printing data at this point

3.7.3 LOAD - Example

The following two examples show the procedure to follow if a log program
is written on a host computer and then transferred into a logger via the FTU.

LOAD - Example 1

Assume a log program was written by the UNIDATA IBM software pack-
age and is now to be loaded into RAM of the FTU.

Note that the size of the log program determines the number of bytes to be
transferred to/from the FTU. The number of bytes to transfer is given by the
location of the last byte of the log program - 384. The last byte of the log
program is specified by PDLASM at assembly.

- set up the host computer (run "PDLIO"), baudrate = 8000 baud

- type RUN "LOAD" on the FTU

input from Keyboard, input from File; or Create Command file?	K Input from keyboard
Load logger or Unload logger	U Specify Unload
Cassette or Ram file OUTPUT file ?	R Store in RAM
Enter OUTPUT file name,type	FILE Program name is FILE,D
use buffer 7 time?	N No, do not use
unload Format, Pointers & buffer, Buffer or Done ?	F Specify transfer with a set of block, location, counts
B,L,C ?	0,50,14 Load program control variables
Format, Pointers & buffer, or Done?	F Specify transfer with a set of block, location, counts
B,L,C?	1,0,7 Load Buffer 0 pointers
Format, Pointers & buffer, or Done?	F Specify transfer with a set of block, location, counts
B,L,C?	1,112,7 Load Buffer 7 pointers
Format, Pointers & buffer, or Done?	F Specify transfer with a set of block, location, counts
B,L,C?	1,128,512 Load Logger program. Note that in this case the last byte of the log progr. given by PDLASM would be 896.
Format, Pointers & buffer, or Done?	D Finished
unload Time Enter Date & Time HHMM DDMMYY ?	1015 221084 enter current time and date

LOAD - Example 2

The following example shows how to load a logger with a log program stored in RAM. It assumes the logger program was written by the UNIDATA IBM software package and loaded into the ram file "FILE","D" as shown in LOAD - Example 1.

input from Keyboard input from File; or Create a command file?	K Input from keyboard
PLot, PRint, Load or Unload	L Load logger [PLOT or PLOTX only]
Cassette or Ram file INPUT file?	R Logger program is contained in RAM
Enter Input file name,type	FILE Program name is FILE,D
set logger time?	N Do not alter the loggers cycle counter.
Format, Pointers & buffer, or Done?	F Specify Load logger with a set of block location counts
B,L,C?	0,50,14 Load Program control variables
Format, Pointers & buffer, or Done?	F Specify Load logger with a set of block location counts
B,L,C?	1,0,7 Load Buffer 0 pointers
Format, Pointers & buffer, or Done?	F Specify Load logger with a set of block location counts
B,L,C?	1,112,7 Load Buffer 7 pointers
Format, Pointers & buffer, or Done?	F Specify Load logger with a set of block location counts
B,L,C?	1,128,512 Load Logger program. Notice that in this case the last byte of the logger program given by PDLASEM would be 896.
Format, Pointers & buffer, or Done?	D Finished

3.7.4 COPY - Example

Assume a logger has been unloaded into the Ram file area of a FTU. You now wish to transfer these data to a host computer (eg. IBM-PC).

- load the program "HOST COMPUTER PROGRAM TO RECEIVE DATA" (see appendix) and run it
- on FTU type RUN "COPY"

Cassette or Ram file INPUT file or X-fr (RS232)?	R read data from Ram file area
Enter INPUT file name,type	FILE Data file name is FILE,D
Cassette or Ram file OUTPUT file or X-fr (RS232)?	X transfer data via serial port
Baud rate ??	1200 select baud rate

4. PLOTX - EXTENSIONS

The program "PLOTX" is an extended version of "PLOT" with capacity to handle circular log buffers, multiple plotter colour options and various data processing options such as maximum, minimum and average. It does this at the expense of FTU memory. On a 16K FTU the amount of free memory available for RAM command files is severely restricted.

4.1 RUNNING PLOTX

1. Load PLOTX into the FTU. Connect datacassette or Data Logger to FTU

2. Type:- RUN then press Return

3. Answer questions as for PLOT

4.1.1 PLOTX - Operator Responses

The questions asked by "PLOTX" are the same as "PLOT" with the following additional questions which relate to "PLOTX" extended features.

Question	Meaning
Buffer number (0-7) (,log size)	number of buffer to unload & optional buffer log size if using a circular buffer in the data logger

Enter the buffer number (followed by the log size if unloading a circular buffer)

Question	Meaning
PLot Format, Pointers & buffer Bypass, Skip buffer or Done?	F = Formatted input. (set of B,L,C) P = Buffer & Pointer format B = Bypass data unloaded using "F" or "B" S = " " " " "P" D = Done (ready to Plot)

Question	Meaning
plot Scales, Line or None?	S = Scales are drawn every interval L = A vertical Line is drawn every interval N = No indication is required of intervals

This command allows extra scale indications to be drawn on the graph

**Colour 03, Probes,
Time or All?**

Changes the color printed across page.
0-3 - select constant color for whole print

<div align="center">

0 = BLACK
1 = BLUE
2 = GREEN
3 = RED

</div>

P = Change color for each field (across page)

T = Change color for each line (down page)

A = P + T (change color across and down page)

** default when Plot selected **

**Field []
bytes,from,to,units,
(location,start,end)**

see PLOT responses
PLOTX offers the following extensions in the byte = field

byte = size of field in bytes, conversion formula and special processing

RED = Red thermistor correction formula
AVE(4) = Average value over period (4 hour average)
MIN(24) = Minimum value over period (Daily minimum)
MAX(1) = Maximum value over period (Hourly maximum)
TOT(6) = Total value over period (6 hour total)

SAMPLE FIELD DESCRIPTION

FIELD 1: MIN(1),0,255,Min   F1,0 (Hourly minimum for field 1 from location 0)

**Field []
title,colour,dotted ?**

(Optional). For each field being print/plotted, this overrides the default setup for a field or column

title = Title for heading on scales (y axis) when plotting.

color = Color to use for field/column overrides the default color for that field/column

dotted = When plotting, sets pitch of dotted line to be used.

0 = undotted (default)   l-15 = dot pitch

Enter interval size (hours)?   Enter the interval duration (in hours)

The "interval" determines when a break is made in the plot and a vertical scale line in drawn

OUTPUT to PLotter   PL = PLotter (Canon X-710) color
OUTPUT to   printer
Dump(com:)   PR = PRinter (80 column Centronics or 2
OUTPUT to PRinter   lines on the X-710 printer) to produce
                           single (color) print out of data
                           D = Dump. (not yet available)

Enter to print device for this tabular report

5. DATA STORAGE FORMAT

Data storage and communications to/from RAM, Cassette tape and RS-232 communication with a host computer conforms to the format detailed below.

5.1 FTU FILE FORMAT

The data file consists of three parts, one HEADER message (Line 1:) one or more DATA messages (Line 2: onwards) and an END message line.

1	HEADER message which contains information about the file.
1 or more	DATA messages which contain the actual data.
1	END message which terminates the file.

5.1.1 HEADER Message Format

The HEADER message is generated by a BASIC 'PRINT' statement and read by a BASIC 'INPUT' statement.

The HEADER information is used to describe the file and its contents, Fields are separated by commas. (The message is terminated with a C/R L/F sequence.)

HEADER message - Line 1:-

filename,ext,cycle,time,filesize   C/R L/F

Where:-

filename	= Name of the data file
ext	= Filename extension
cycle	= Data Logger cycle time in seconds (usually 5)
time	= Time and Date in logger cycles past 1JAN80 (locn 4. Data Logger format)
filesize	= Size file in bytes (excluding this HEADER Line 1: but including all DATA messages and the END line)

5.1.2 DATA Message Format

There are one or more DATA messages used to store a data file. The format of the DATA message is designed to be generated by a BASIC 'PRINT' statement and read by a BASIC 'INPUT' statement.

DATA messages - Line 2: onwards

    data C/R L/F

data = up to 252 characters coded in Hexadecimal (2 characters per data logger byte). The characters are sent high order 4 bits followed by low order 4 bits such that the following BASIC instructions would have VALUE as the first data logger byte in the ASCII DATA message (STRING$)

$$VALUE = VAL (\text{"\&H"} + LEFT\$(STRING\$,2))$$

5.1.3 END Message Format

A single line is used to terminate the data file.

END message -

    END C/R L/F

5.2 HOST COMPUTER PROGRAM TO RECEIVE DATA

The following sample BASIC program will save the information sent by the COPY program via the RS-232 communications link. The sample program is written for an IBM-PC type system, however a similar program will operate on any computer.

```
 10 INPUT "Enter Filename for COPY data";F$
 20 OPEN F$ FOR OUTPUT AS #2
 30 OPEN "COMl:1200,n,8,2,rs,cs,ds,cd" AS #l
 40 INPUT #1,A$
 50 IF A$ = "END" THEN 100
 60 PRINT #2,A$
 65 PRINT A$
 70 GOT0 40
```

```
100 CLOSE  #1
110 CLOSE  #2
120  PRINT "File ";F$;"  saved
130 END
```

6. NFTU COMMANDS

The program NFTU is a simple Field Test Unit program which will communicate with the Model 6003 Data Logger and display (or alter) the Data Logger memory contents.

This Software Package is unsupported by UNIDATA. This means that the software is supplied 'as is' and UNIDATA does not intend to correct any errors or make further improvements to the package.

Memory location may be displayed as groups of 4 single bytes or as a 32 bit integer number.

6.1 OPERATION

1. Turn the FTU on using the "on/break" key.

2. Plug the FTU 25 pin D type connector into the data logger computer connector.

3. The FTU will display the value of the cycle counter (location 4)

4. Press a key L, B, P, ASDF or a 'space' and wait for a prompt.

5. When finished, remove the FTU plug and turn the power off using the "off key.

6.1.1 L COMMAND

The L command allows you to enter a number from 0 to 255 and view that byte LOCATION in the current block. The display is reset to 'byte mode'.

6.1.2 B COMMAND

The B command allows you to enter a number from 0 to 255 and shift to that BLOCK of memory for display or alteration. The display is reset to 'byte mode'.

6.1.3 P COMMAND

The P command allows you to PUT new data to memory. Only one byte location may be altered at a time. The location altered is the first byte displayed (the one indicated by the status line). The new value must be between 0 and 255. Use the 'S & D' keys to step backwards and forwards to adjacent locations to be altered.

6.1.4 CURSOR KEY COMMANDS

The Cursor Keypad (at the top right of the FTU keyboard) step the displayed location backwards (or forwards) one byte using the & - command keys, and backwards (or forwards) four bytes using the ^ & V command keys.

6.1.5 'space' COMMAND

The 'space' bar toggles the display between 'byte mode' (4 individual byte display) and 'integer mode' (4 byte, 32 bit single integer).

6.2 INITIALIZATION

The initialization sequence should be avoided if possible. The FTU will initialize if the batteries are removed or go flat. Therefore the batteries should be changed when the low battery warning appears and should be changed with the power pack inserted so as the memory does not lose power. However if the program contained in the FTU has been lost, perform the following sequence.

(<RET > in the following sequence is the lower right hand key marked "RETURN" and $ is the dollar sign appearing above the 4)

Type in the program appearing at the end of the Section
Enter "START$ = "RUN" + CHR$(l3)
Enter 'OFF1 <RET > '\

The field test unit will power down and when next press the on button the FTU should appear as normal.

The following is a table of addresses versus channel viewed on the Field Test unit.

6.3 CHANNEL ADDRESSES

The following Table defines some important location in the Data Logger.
Refer to the STARLOG Portable Data Logger Hardware Supplement for
a complete List of location definitions.

ChanneI	# BLOCK 0 Address on field test unit
Analog 0	16
Analog 1	17
Analog 2	18
Analog 3	19
Analog 4	20
Analog 5	21
Analog 6	22
Analog 7	23
Counter 0	24 thru 27
Counter 1	28 thru 31

All values are displayed in decimal and may range from 0 to 255 (8 bit byte)
or 0 to 4 biion (32 bit integer).

6.4 "NFTU.X07"   - PROGRAM LISTING

```
1      DEFINT   B,L,C:B  = 0:L = 0:C = 4:M = 2:CONSOLE 0,4,0
2      CLS
3      GOSUB 22:LOCATE    0,0:ON M GOT0 4,5
4      PRINT V;:GOTO 8
5      FOR I=0 TO 3
6      PRINT USING"####";VAL("&H"  + MID$(L$,(I*2)  + 1,2));
7      NEXT I
8      LOCATE 0,1:PRINT   USING"####";B;L
9      LOCATE 0,3:PRINT"?   LB  P";
10     A$ = INKEY$:IF A$ = " " THEN 3
11     I = INSTR("LBP",A$):A  = ASC(A$)-27:IF   A0 THEN ON A
       GOTO  18,17,16,19
12      ON I GOTO 14,13,20,21:GOTO 3
```

```
13    CLS:INPUT"LOC    ";L:GOTO  3
14    IF M=1 THEN M=2 ELSE M=1
15    GOTO 2
16    L=L-4:GOTO 3
17    L = L-l:GOTO  3
18    L=L+l:GOTO 3
19    L=L+4:GOTO 3
20    CLS:INPUT"BLOCK";B:GOTO  3
21    CLS:INPUT"PUT    VALUE "; V:M =0:C = 1:GOTO  3
22    A$ = RIGHT$(HEX$(256 + B),2)
23    A$ = A$ + RIGHT$(HEX$(256+ L),2)
24    A$ =A$ + RIGHT$(HEX$(256+ C),2)
25    L$ = "":IF   M0 THEN 31
26    FOR I=1 TO 4
27    J=V AND &HFF:V=V/256
28    L$ = L$ + RIGHT$(HEX$(256+J),2)
29    NEXT I
30    B$ = A$ + LEFT$(L$,C*2)
31    INPUT#l,"COM:",8000:ON  ERROR  GOTO 42
32    INPUT #1,L$:  IF INSTR(L$,"*")   = 0 THEN 32
33    IF M0 THEN 35
34    PRINT#l,"P"  + B$;:M = 2:C = 4
35    PRINT#l,"G"  + A$;:INPUT#l,L$
36    PRINT#1,"KKK";:ON  ERROR    GOTO 0:V = 0
37    IF M  =2  THEN  RETURN
38    FOR I=0 TO C-1
39    J = (I*2)  + l:V = V + (VAL("&H"+ MID$(L$,J,2))*256^ I)
40    NEXT I
41    RETURN
42    RESUME
```

7. FTUC COMMANDS

7.1 DISPLAY FORMAT

The display of the FTU has three formats available. These formats can be selected at the touch of a button. Normally as many bytes as possible are displayed on the screen at all times. For example - if you were displaying the contents of the logger memory as single bytes then four bytes could be displayed per screen line, making a total of eight bytes displayed (only the top two lines of the display are used for display purposes).

The three formats available are:

7.2 DISPLAY OF THE LOGGERS CURRENT MEMORY VALUES

In this format the values are not scaled and as displayed as a number from O-255. Eight values are displayed across the screen and they represent the current selected memory address location followed by the successive seven memory locations. The current memory location can be changed using keystrokes outlined later. This display format is the default when the FTU is first powered up and the logger connected.

EXAMPLE: When first powered up and connected the FTU will display the following (or similar):

> 10300
> x4400
> Address = 0

The '10' is the version of logger connected. (Memory location 0)

The '3' is the runtime of the program in the logger. (Memory location 1)

The '0's" are memory locations not used.

The 'X' represents a value that will change on your screen. This is Memory Location 4 and is where the logger shows the current clock value.

The '44" is also a changing value and is related to your loggers clock value (Memory Location 6) [See Hardware Supplement 6200 for further details of the logger's memory locations].

7.3 USER DEFINED SCREEN FORMAT

This screen format allows the user to set up and save a custom designed format for a specific application. This routine is initialised by pressing the "E" key. The FTU will then prompt the user to enter in:

Offset, this is to select the chosen memory byte to be displayed or altered. Up to 12 bytes can be displayed on the screen at one time.

If an offset larger than 11 is chosen then previous bytes must be removed to make room for the chosen byte. This feature allows the user to skip over certain bytes and yet display others.

Bytes this entry is used with certain instruments which require a 2 bytes to send all data to the logger, (i.e. Hi-Res Interface, Water Level Instrument). Most raw data instruments require only one byte. To display time in the format a 4 byte input is required.

Formula this entry allows the user to select a defined formula from a list of pre defined formulas or to display the raw logger value.

Select the appropriate formula for your application from the list below

Key Stroke	Function
None	Do not display this entry
N	None - Do not use any formula on this entry
R	Red - Red thermistor formula (6507A)
Y	Yellow - Yellow thermistor formula (6507B)
V	Violet - Violet thermistor formula (6507C)
D	Direction - Use the wind direction formula
S	Use the soil moisture formula (6513A)
F	Full scale - User defined full scale entry
H	Hi-Res Entry is a 2's compliment 13 bit value
T	Time - Decode the entry as a date and time

If formulas RYVS have been selected then the FTU will respond with a prompt for the user to enter the value of the reference resistor used with the transducer.

If the formulas FH have been selected then the FTU will prompt with a line "Min value?". The minimum desired value for the scaling should then be

entered. The FTU will then prompt with "Max Value?". The maximum desired value for the scaling should then be entered. The FTU will now only display values from the minimum to maximum for the selected memory location/s.

After responding to the above prompts the FTU will prompt

"Using #####"

This is a feature that enables the FTU to custom format the decimal structure and units for the displayed value.

EXAMPLE:

By typing the following to the USING prompt

"##.# Celsius"

The FTU will display the memory value in the format

"34.4 Celsius"

If the screen is cleared beforehand, (SHIFT-HOME), this will be the only information displayed by the FTU.

For further information on "PRINT USING" see the Canon X-07 "Basic Reference Manual" page 92.

7.4 MEMORY ADDRESSING

There are three ways to address memory within the logger using FTU-PROM:

Block number	("B")
Location from start of current Block	("L")
Absolute address	("A")

7.5 CURSOR KEYPAD

Using the direction keys, the display may be shifted forward and backward by one value, or by a given screen step. The screen step (STEPSIZE) is usually set to one whole screen, calculated considering the size and mode that is in effect.

The default STEPSIZE can be set by pressing "S". The FTU will then respond "Step size?" . The entered number will be the resultant number of

memory locations that the display will skip forward or backwards to when the Up arrow or Down arrow is pressed.

This step size can be saved in a screen format file.

The SPACEBAR will reset the screen to its initial state.

7.6 SCREEN FORMAT FILES

The FTU-PROM has a feature that allows a custom designed screen format file. After designing a screen format using the "E" key the screen can be saved by pressing the "W" (write) key. The FTU will then prompt for a file name. After obtaining the file name the FTU will save the screen format and resume working. 350 Bytes of RAM are required for each screen set up. The screen formats and remaining memory can be viewed by pressing "F". To load in a new screen format press "R" followed by the filename of the desired screen   format.

Warning: Use of a filename containing the letters "FTU" may cause the FTU to lock up on power on.

7.7 COMMANDS TO MODIFY DATA LOGGER

The FTU-PROM has the ability to display and modify the data loggers memory. The appropriate commands and their functions are:

7.7.1 "P" - Put

This command allows the user to change the values of the loggers RAM memory. Up to eight values can be changed at one command by typing consecutive values separated by comma's.

EXAMPLE:
    Press "P"
    FTU responds "?"
    Type 0,0,0,0 <RET> <RET>

The value 0 will be entered in the RAM from the current address upwards. i.e. If the FTU was at address 128 the value 0 should appear in address 128 - 132.

7.7.2 "T" - TIME

This command enables the user to check and/or reset the logger's time and date. The Canon X-07's date and time MUST be set accurately for this procedure. If the Canon's time/date needs to be changed type "t" to reset it, (see below under X-07 Commands).

EXAMPLE:
  Press "T"
  FTU display responds:
  10:58:28   10:45:21
  87/05/29   87/05/28
  logger   canon
  Press Return or Put

If the date on the logger side is as desired then press RETURN to exit. If not the press Put - "P" to set the logger's date to that of the Canon.

7.7.3 "d" - DISPLAY *

This command causes the FTU to display current information from the logger on:

  • Cycle time of the logger

  • Log size (number of bytes used per log)

  • Log interval in minutes and seconds

  • Time of the first log, the number of logs made and the number of full days the logger has been recording

EXAMPLE:
  Press shift-D ("d")
  FTU display responds:
  1 second logger
  1 byte log size
  1 min 0 second
  log interval
  First log at
  12:09:00 87/05/29
  3 logs 0 days
  press RETURN

7.7.4 "r" - RESET *

This command resets the logger data storage to an original state. All data is lost and the logger starts logging immediately.

7.7.5 "j" & "a" - JUMP TO LOG & ADDRESS toggle *

These two commands are used together to view data in the logger memory. By pressing "j" the user can access specific logs. Selection of a log number will cause the FTU to display the logged data. Use of the cursor key pad will enable the user to move through the logs.

By pressing "a" the user can interchange the bottom line from an address display to that of the loggers time reading at each specific log. If the screen is cleared and set up prior to entering "j" then the FTU will display the logged data in actual units rather than raw bytes.

7.7.6 "D" - DATA

This command will cause the FTU to prompt "Data Buffer (0-7)". After receiving the desired buffer number the FTU will then display information on that buffer pointer from the logger.

7.7.7 "J" - JUMP to ADDRESS

Jump to address pointed to by the start, end or current pointer, (this information can be displayed by the above command). The user will be required to enter in the desired buffer number (0-7). The user can select the current, end or start buffer by pressing "S"-start, "E"-end or "C"-current.

7.8 X-07 DIRECT COMMANDS FROM FTU-PROM

7.8.1 "t" - TIME

To reset the X-07's internal clock/calendar type "t". The new date if required is entered by writing over the old date and then pressing "RETURN".

7.8.2 "F" - FREE

This command will display all files held in RAM and available memory. (See X-07 manual for more details).

7.8.3 "Q" - QUIT

Pressing this key will return the X-07 to BASIC.

7.8.4 "b" - BAUD

This command will allow the user to set the FTU's communication baud rate. The default is 8000 baud. Users of remote telemetry systems should consult their manual 6213 to decide on the correct baud rate if using a MODEM.

7.8.5 "s" - S300

This command will cause the FTU-PROM to exit from normal communications with the logger and to assume a "dumb terminal" mode for communications with another terminal.

7.8.6 "x" - TRANSFER

This command will allow the FTU to transfer files between itself and an IBM PC compatible using UNIDATA's PDL-FTU software version 1.5 or later. File transfer can be done in either direction. Once "x" has been pressed all commands take place from the PC. See software manual 6201 "STARLOG Software Manual" for further details.

7.9 INDIRECT AND MISCELLANEOUS COMMANDS

7.9.1 "@" - INDIRECT JUMP

Jump to the address pointed to by first 2 bytes on the screen.

7.10 SUMMARY OF COMMANDS

KEY	FUNCTION
Right arrow	Step Forward 1 byte of logger memory
Left arrow	Step Backward 1 byte of logger memory
Down arrow	Step Forward STEPSIZE bytes of logger memory
Up arrow	Step Backward STEPSIZE bytes of logger memory
S	Set the value of STEPSIZE
A	Move to a new ADDRESS of logger memory
B	Move to a new BLOCK of logger memory
L	Move to a new LOCATION within the current block
@	to the ADDRESS pointed to by the 1st 2 bytes on the screen
T	Display and set logger TIME and DATE
t	Set FTU time and date
Spacebar	Reset the FTU screen to initial state
HOME	Clear and redraw the current screen
CLR	Clear (Shift/Home) the current screen of all entries and instruments
H	Display HELP file
Q	Quit and go to BASIC
I	Select or add an instrument to the current display screen Enter the catalog number of instrument followed by the input channel of each instrument.
E	Define an entry in the current display screen (See User Defined Screen Format)
W	Write (Save) the current screen setup
R	Read a previously saved screen setup
F	Display list of current screen setups (and remaining space for new setups)
P	Put data into logger memory
D	Display current data buffer pointers

(table continues on the next page)

J	Jump to address pointed by the (S)tart, (E)nd or (C)urrent pointer
s	Set FTU to direct communication mode.
b	Set or change FI'U communication baud rate
x	Transfer programs between an IBM and X-07 using PDLFTU software
j	jump to a specific log entry *
a	toggle ADDRESS display to TIME of current log entry*
r	RESET the logger ready for another recording session* ** ALL RECORDED DATA WILL BE LOST **
d	Display logger information on: Cycle time Log size Log interval Time of first log, number of logs made and the number of full days the logger has been recording.*

Footnote: * indicates commands that require the logger to be programmed with IBM software package V#1.8 or later.